ESP-101

Plasma Arc Cutting System

Instruction Manual (English)

This manual provides installation and operation instructions for the following ESP-101 cutting packages starting with Serial No.: PxxJ943xxx

Consoles:

P/N 0558004880 - ESP-101 460V
P/N 0558005215 - ESP-101 380-400V CE

0558007871

BE SURE THIS INFORMATION REACHES THE OPERATOR.
YOU CAN GET EXTRA COPIES THROUGH YOUR SUPPLIER.

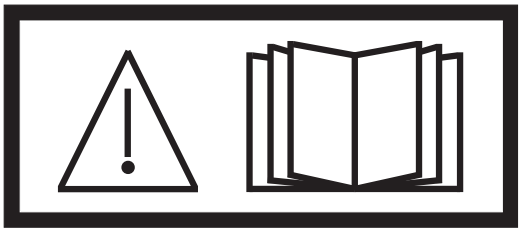
CAUTION

These INSTRUCTIONS are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for arc welding and cutting equipment, we urge you to read our booklet, "Precautions and Safe Practices for Arc Welding, Cutting, and Gouging," Form 52-529. Do NOT permit untrained persons to install, operate, or maintain this equipment. Do NOT attempt to install or operate this equipment until you have read and fully understand these instructions. If you do not fully understand these instructions, contact your supplier for further information. Be sure to read the Safety Precautions before installing or operating this equipment.

USER RESPONSIBILITY

This equipment will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts when installed, operated, maintained and repaired in accordance with the instructions provided. This equipment must be checked periodically. Malfunctioning or poorly maintained equipment should not be used. Parts that are broken, missing, worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, the manufacturer recommends that a telephone or written request for service advice be made to the Authorized Distributor from whom it was purchased.

This equipment or any of its parts should not be altered without the prior written approval of the manufacturer. The user of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair or alteration by anyone other than the manufacturer or a service facility designated by the manufacturer.



READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING.

PROTECT YOURSELF AND OTHERS!

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1.0 Safety Precautions

Users of ESAB welding and plasma cutting equipment have the ultimate responsibility for ensuring that anyone who works on or near the equipment observes all the relevant safety precautions. Safety precautions must meet the requirements that apply to this type of welding or plasma cutting equipment. The following recommendations should be observed in addition to the standard regulations that apply to the workplace.

All work must be carried out by trained personnel well acquainted with the operation of the welding or plasma cutting equipment. Incorrect operation of the equipment may lead to hazardous situations which can result in injury to the operator and damage to the equipment.

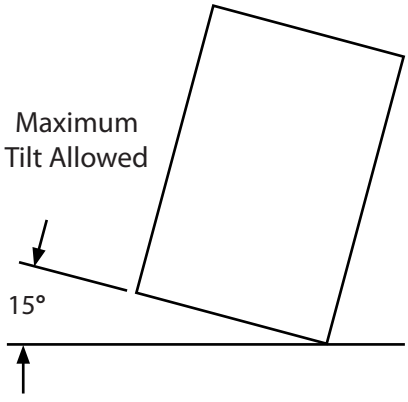
1. Anyone who uses welding or plasma cutting equipment must be familiar with:
   - its operation
   - location of emergency stops
   - its function
   - relevant safety precautions
   - welding and / or plasma cutting
2. The operator must ensure that:
   - no unauthorized person stationed within the working area of the equipment when it is started up.
   - no one is unprotected when the arc is struck.
3. The workplace must:
   - be suitable for the purpose
   - be free from drafts
4. Personal safety equipment:
   - Always wear recommended personal safety equipment, such as safety glasses, flame proof clothing, safety gloves.
   - Do not wear loose fitting items, such as scarves, bracelets, rings, etc., which could become trapped or cause burns.
5. General precautions:
   - Make sure the return cable is connected securely.
   - Work on high voltage equipment **may only be carried out by a qualified electrician**.
   - Appropriate fire extinquishing equipment must be clearly marked and close at hand.
   - Lubrication and maintenance **must not** be carried out on the equipment during operation.

Enclosure Class

The **IP** code indicates the enclosure class, i.e. the degree of protection against penetration by solid objects or water. Protection is provided against touch with a finger, penetration of solid objects greater than 12mm and against spraying water up to 60 degrees from vertical. Equipment marked **IP23S** may be stored, but is not intended to be used outside during precipitation unless sheltered.

CAUTION

If equipment is placed on a surface that slopes more than 15°, toppling over may occur. Personal injury and / or significant damage to equipment is possible.



WARNING

WELDING AND PLASMA CUTTING CAN BE INJURIOUS TO YOURSELF AND OTHERS. TAKE PRECAUTIONS WHEN WELDING OR CUTTING. ASK FOR YOUR EMPLOYER'S SAFETY PRACTICES WHICH SHOULD BE BASED ON MANUFACTURERS' HAZARD DATA.

ELECTRIC SHOCK - Can kill.
- Install and earth (ground) the welding or plasma cutting unit in accordance with applicable standards.
- Do not touch live electrical parts or electrodes with bare skin, wet gloves or wet clothing.
- Insulate yourself from earth and the workpiece.
- Ensure your working stance is safe.

FUMES AND GASES - Can be dangerous to health.
- Keep your head out of the fumes.
- Use ventilation, extraction at the arc, or both, to take fumes and gases away from your breathing zone and the general area.

ARC RAYS - Can injure eyes and burn skin.
- Protect your eyes and body. Use the correct welding / plasma cutting screen and filter lens and wear protective clothing.
- Protect bystanders with suitable screens or curtains.

FIRE HAZARD
- Sparks (spatter) can cause fire. Make sure therefore that there are no inflammable materials nearby.

NOISE - Excessive noise can damage hearing.
- Protect your ears. Use earmuffs or other hearing protection.
- Warn bystanders of the risk.

MALFUNCTION - Call for expert assistance in the event of malfunction.

READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING.

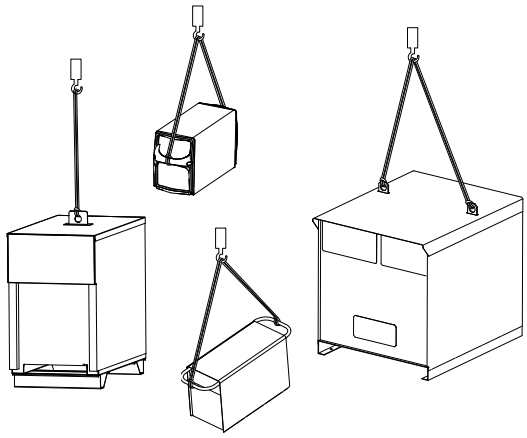
PROTECT YOURSELF AND OTHERS!

CAUTION

This product is solely intended for plasma cutting. Any other use may result in personal injury and / or equipment damage.

CAUTION

To avoid personal injury and/or equipment damage, lift using method and attachment points shown here.



WARNING **USE THE ESAB PT-37 PLASMARC TORCH WITH MECHANIZED CONSOLES. USE OF TORCHES NOT DESIGNED FOR USE WITH THIS CONSOLE COULD CREATE AN ELECTRIC SHOCK HAZARD.**

2.1 General

As shipped, the ESP-101 is fully assembled and ready to cut after being connected to input power, a source of compressed air, and a PT-37 torch. The ESP-101 system uses the heavy-duty PT-37 (Mechanized Plasma) torch to deliver cutting power for cutting materials up to 1-1/4 inch (32 mm) thick. Refer to the following pages for descriptions of the ESP-101 packages available as well as performance specifications.

2.2 Scope

The purpose of this manual is to provide the operator with all the information required to install and operate the ESP-101 Plasma Arc Cutting System. Technical reference material is also provided to assist in troubleshooting the cutting system.

2.3 ESP-101 Plasma Arc Cutting System:

The ESP-101 plasma cutting system combines the newly redesigned ESP-101 console and PT-37 torch. The PT-37 plasma cutting torch is designed to provide increased performance and longer consumable life resulting in higher production rates at lower costs.

Specifications: ESP-101

Pierces 3/4 inch (19.1 mm); Cuts 1-1/4 inch (32 mm) for Carbon & Stainless Steel
Pierces 3/4 inch (19.1 mm); Cuts 1 inch (25 mm) for Aluminum

Input.....460 vac, 3 phase 60 Hz, 25 A
.....380/400 vac, 3 phase 50/60 Hz, 30/29 A
Output.....100 amps @ 160v - 100% duty cycle

Voltage requirements.....Idle 380-400, 460V, +/- 10%
.....Cutting 380-400, 460V, +/- 15%

Air Supply Requirements .....500 cfh @ 90 psig (236 l/min @ 6.2 bars)

Efficiency 89%
Power Factor 92%

CE 380-400 vac ..... $*S_{sc\ min}$ 4 MVA
..... $*Z_{max}$ 0.039 Ω

Weight:.....125 lb (56.7 kg)

Duty Cycle: The duty cycle refers to the time as a percentage of a ten-minute period that you can cut at a certain load without overheating. The duty cycle is valid for 40 degrees C.

***$S_{sc\ min}$:** Minimum short circuit power on the network in accordance with IEC61000-3-12.

***Z_{max} :** Maximum permissible line on the network impedance in accordance with IEC61000-3-11.

2.4 Package Ordering Information:

Mechanized Package Ordering Information:

The components that are included in the ESP-101 mechanized packages may be purchased separately by using the appropriate P/N when placing orders. Individual part numbers are listed below:

Available Packages:

ESP-101:

460 V CNC **PT-37** with rack 25 ft (7.6 m) 0558009450
460 V CNC **PT-37** with rack 50 ft (15.2 m) 0558009451
460 V CNC **PT-37** w/o rack 25 ft (7.6 m) 0558009452
460 V CNC **PT-37** w/o rack 50 ft (15.2 m) 0558009453

380-400 V CE CNC **PT-37** with rack 25 ft (7.6 m) 0558009458
380-400 V CE CNC **PT-37** with rack 50 ft (15.2 m) 0558009459
380-400 V CE CNC **PT-37** w/o rack 17 ft (5.2 m) 0558009460
380-400 V CE CNC **PT-37** w/o rack 25 ft (7.6 m) 0558009461
380-400 V CE CNC **PT-37** w/o rack 50 ft (15.2 m) 0558009462

ESP-101 Multi-Voltage:

The ESP-101 multi-voltage console ships as a ESP-101 460 V console and a separate TUA2 Auto-Transformer.

208-575 V CNC **PT-37** with rack 25 ft (7.6 m) 0558009454
208-575 V CNC **PT-37** with rack 50 ft (15.2 m) 0558009455
208-575 V CNC **PT-37** w/o rack 25 ft (7.6 m) 0558009456
208-575 V CNC **PT-37** w/o rack 50 ft (15.2 m) 0558009457

ESP-101 Consoles:

460 V Console 0558004880
380-400 V CE Console 0558005215

Multi-Voltage Consoles:

The ESP-101 multi-voltage console ships as a ESP-101 460 V console and a separate TUA2 Auto-Transformer.

208, 230, 400, 460, 475, 500, 575 V 0558004881

WARNING **DO NOT USE OXYGEN WITH THIS TORCH! A HAZARDOUS FIRE MAY RESULT.**

2.5 PT-37 Torch Data

ESP-101 mechanized console uses the PT-37 torch. For cut data information, breakdown of parts, dimensions and maintenance refer to torch manual.

PT-37 Torches:

PT-37 Torch with rack 4.5' (1.4m) 0558004860
PT-37 Torch with rack 17' (5.2m) 0558004861
PT-37 Torch with rack 25' (7.6m) 0558004862
PT-37 Torch with rack 50' (15.2m) 0558004863
PT-37 Torch w/o rack 4.5' (1.4m) 0558004894
PT-37 Torch w/o rack 17' (5.2m) 0558004895
PT-37 Torch w/o rack 25' (7.6m) 0558004896
PT-37 Torch w/o rack 50' (15.2m) 0558004897

2.6 System and Optional Accessories

TUA2 Auto-Tranformer 0459145880

Converts an input voltage of 208, 230, 400, 475, 500, or 575 V to 460 V for use with an ESP-101 460 V console.

Remote Junction Box.....0558004887

The Remote Junction Box provides a means to extend the total length of the PT-37 Torch. When used in combination with 50 ft., 75 ft., or 100 ft. extension cables, and any standard length of PT-37 Plasma Torch from 4.5 ft. to 50 ft., a maximum torch length of 150 feet can be achieved.

Extension Cable 50 ft. (15.2 m).....p/n 0558004888
75 ft. (22.9 m) .....p/n 0558009266
100 ft. (30.5 m).....p/n 0558004889

Torch Holder Assembly.....p/n 0558005926

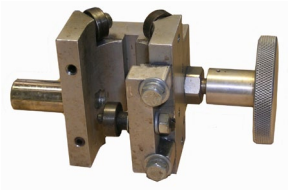


Plate Rider.....p/n 0560936972

Used to maintain a constant standoff while cutting thin materials or using machines without automatic height control.

CNC Cable 25 ft. (7.6 m).....p/n 0558008833
50 ft. (15.2 m) .....p/n 0558008834

Connects between the CNC interface receptacle on the rear panel and the CNC.

Remote Hand Switch with 25 ft. (7.6 m) lead..... p/n 0558005548
with 50 ft. (15.2 m) lead ..... p/n 0558005549

Enables non-automated mechanized cutting using the PT-37 or PT-38 torch. Connects to the CNC interface receptacle on the rear panel.

Gas Flow Measuring Kit .....p/n 19765 ("CE" units - 0558000739)

Valuable troubleshooting tool allows measurement of the actual air flow through the torch.

WARNING **INSTALLING OR PLACING ANY TYPE OF FILTERING DEVICE WILL RESTRICT THE VOLUME OF INTAKE AIR, THEREBY SUBJECTING THE POWER SOURCE INTERNAL COMPONENTS TO OVERHEATING. THE WARRANTY IS VOID IF ANY TYPE OF FILTER DEVICE IS USED.**

3.1 General

Proper installation is important for satisfactory and trouble-free operation of the ESP-101 cutting package. It is suggested that each step in this section be studied carefully and followed closely.

3.2 Equipment Required

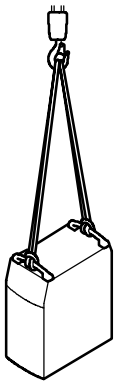
A source of clean, dry, oil-free air that supplies 500 cfh (236 l/m) at 90 psig (6.2 bars) is required for the cutting operation. The air supply should not exceed 150 psig (10.3 bars) (the maximum inlet pressure rating of the air filter-regulator supplied with the package).

CAUTION **Position the ESP-101 at least 10 feet (3 meters) from the cutting area. Sparks and hot slag from the cutting operation can damage the unit.**

3.3 Placement and Location

After selecting an installation site, place the ESP-101 in the desired location. The unit may be lifted by either an overhead crane or forklift truck. If using forklift truck, be sure that the lift forks are long enough to extend completely under the base. If using straps, use two separate straps as shown in the illustration.

Adequate ventilation is necessary to provide proper cooling of the ESP-101. The amount of dirt, dust, and excessive heat to which the equipment is exposed, should be minimized. There should be at least one foot of clearance between the ESP-101 power source and wall or any other obstruction to allow freedom of air movement through the power source.



3.4 Inspection

1. Remove the shipping container and all packing material and inspect for evidence of concealed damage which may not have been apparent upon receipt of the ESP-101. Notify the carrier of any defects or damage at once.
2. Check container for any loose parts prior to disposing of shipping materials.
3. Check air louvers and any other openings to ensure that any obstruction is removed.

WARNING

ELECTRIC SHOCK CAN KILL! PRECAUTIONARY MEASURES SHOULD BE TAKEN TO PROVIDE MAXIMUM PROTECTION AGAINST ELECTRICAL SHOCK. BE SURE THAT ALL POWER IS OFF BY OPENING THE LINE (WALL) DISCONNECT SWITCH AND BY UNPLUGGING THE POWER CORD TO THE UNIT WHEN CONNECTIONS ARE MADE INSIDE OF THE POWER SOURCE.

3.5 Primary Input Connections

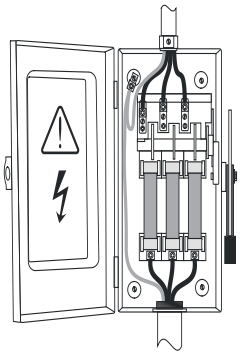
The ESP-101 460V consoles are equipped with approximately 15 ft. of 4-conductor input power cable for 3 phase connection.

See specification section or rating plate.

STANDARD UNITS (NON-CE)			CE UNITS (EUROPE)	
PHASE	3		PHASE	3
L1	Black		L1	Brown
L2	Red		L2	Black
L3	White		L3	Gray
GND	Green		GND	Green/Yel

A. 460V

PRIMARY INPUT POWER CABLE



CUSTOMER FUSED LINE DISCONNECT SWITCH (See Table 3-1)

B. 380-400V

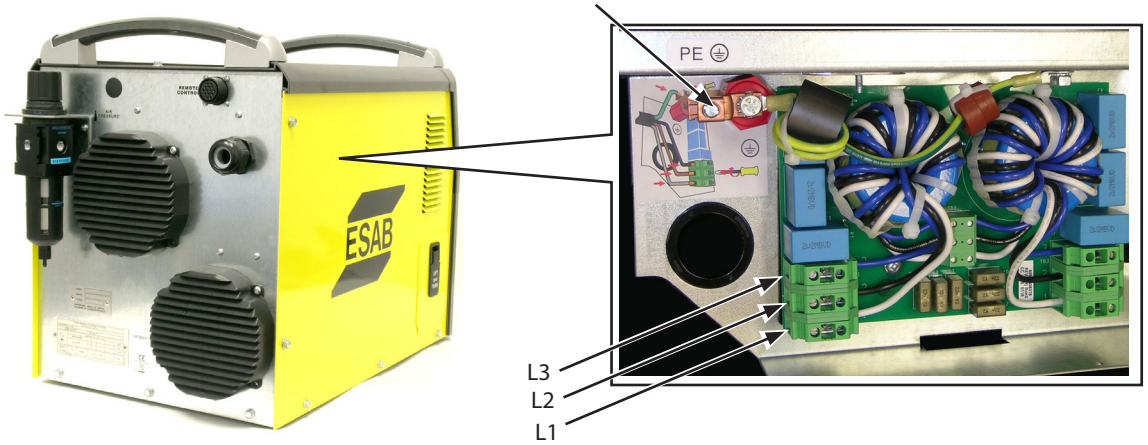


Figure 3-1. Input Connections

WARNING

ELECTRIC SHOCK CAN KILL! BEFORE MAKING ELECTRICAL INPUT CONNECTIONS TO THE POWER SOURCE, "MACHINERY LOCKOUT PROCEDURES" SHOULD BE EMPLOYED. IF THE CONNECTIONS ARE TO BE MADE FROM A LINE DISCONNECT SWITCH, PLACE THE SWITCH IN THE OFF POSITION AND PADLOCK IT TO PREVENT INADVERTENT TRIPPING. IF THE CONNECTION IS MADE FROM A FUSEBOX, REMOVE THE CORRESPONDING FUSES AND PADLOCK THE BOX COVER. IF IT IS NOT POSSIBLE TO USE PADLOCKS, ATTACH A RED TAG TO THE LINE DISCONNECT SWITCH (OR FUSE BOX) WARNING OTHERS THAT THE CIRCUIT IS BEING WORKED ON.

WARNING

THE CHASSIS MUST BE CONNECTED TO AN APPROVED ELECTRICAL GROUND. FAILURE TO DO SO MAY RESULT IN ELECTRICAL SHOCK, SEVERE BURNS OR DEATH.

WARNING

BEFORE MAKING ANY CONNECTIONS TO THE POWER SOURCE OUTPUT TERMINALS, MAKE SURE THAT ALL PRIMARY INPUT POWER TO THE POWER SOURCE IS DEENERGIZED (OFF) AT THE MAIN DISCONNECT SWITCH AND THAT THE INPUT POWER CABLE IS UNPLUGGED.

Before connecting to input power, make sure there is a line (wall) disconnect switch with fuses or circuit breakers at the main power panel. You may either use the factory-installed input power cable 4/c, type SO (90 °C), 15 ft (4.6 m) length or provide your own input power leads. If you choose to provide your own, make sure they are insulated copper conductors. You must have three (3 phase) power leads and one ground wire. The wires may be heavy rubber covered cable or may be run in a solid or flexible conduit. Ensure the ground lead is sufficiently long inside the machine. In an event where the power cord is pulled from the machine, the ground lead **must not** break from the ground connection before the power leads have broken from their connection. Refer to Table 3-1 for recommended input conductors and line fuse sizes.

ESP-101

Input Requirements			Input & Gnd	Fuse
Volts	Phase	Amps	Conductor CU/AWG	Size Amps
380(CE)	3	30	6 mm^2	40
400(CE)	3	29	6 mm^2	40
460	3	25	8	35

ESP-101 (With Optional Auto-transformer)

Input Requirements			Input & Gnd	Fuse
Volts	Phase	Amps	Conductor CU/AWG	Size Amps
208	3	53	6	70
230	3	50	6	70
400	3	29	6 mm^2	40
460	3	25	8	35
475	3	24	8	35
500	3	22	10	30
575	3	18	10	25

Table 3-1. Recommended Sizes For Input Conductors and Line Fuses

3.5.1 TUA2 Auto-Transformer Primary Input Connections

Connecting a Multi-Voltage Version

The ESP-101 460V version is equipped with an input power cable which may be used to connect to the output of the TUA2 Auto-Transformer. You may either use the factory-installed input power cable (4/c, type SO (90 °C) or provide your own input power leads. If you choose to provide your own, make sure they are insulated copper conductors. You must have three (3 phase) power leads and one ground wire. Refer to Table 3-1 for recommended input conductors.

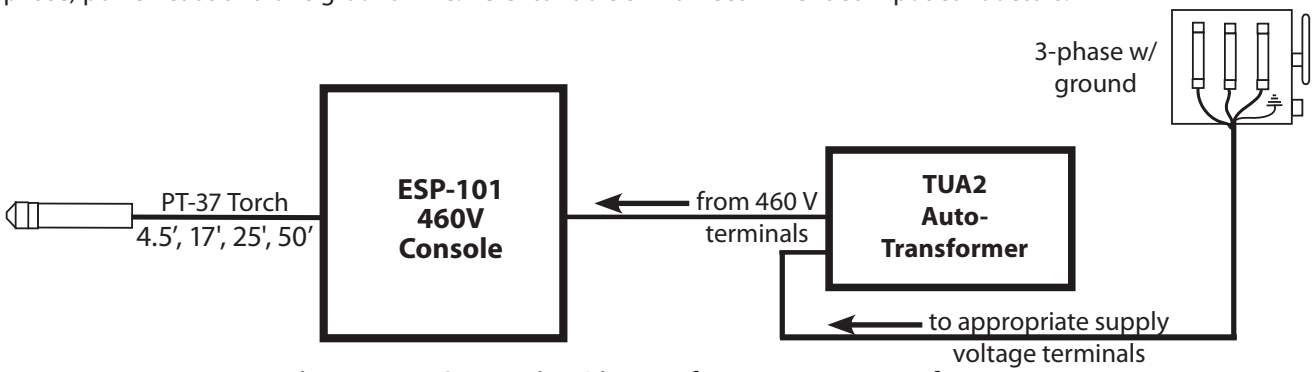


Figure 3-2a. Connection Diagram for TUA2 Auto-Transformer

Primary Power Cable from ESP-101 to TUA2 Auto-Transformer

Step 1: Begin by preparing the power cable, then positioning in the TUA2 as shown.

Note:
L1, L2 & L3 strip wires 3/8" (9.5 mm) .
GND wire strip 1" (25.4 mm) or
5/16" ring terminal.

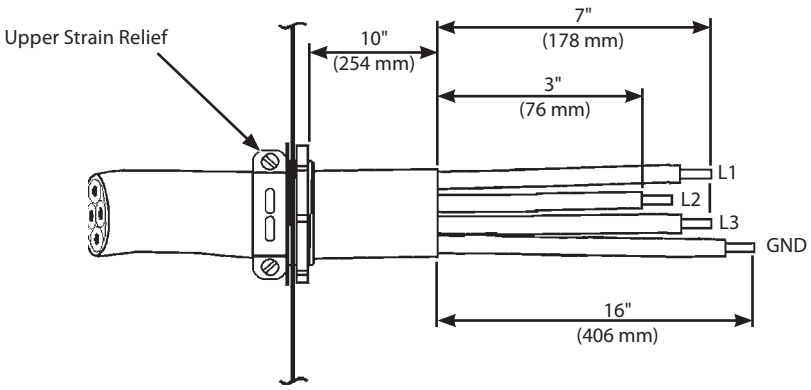


Figure 3-2b. Primary Power Cable from ESP-101 to TUA2 Auto-Transformer

Step 2: Route the power cable through the upper strain relief of the TUA2 Auto-Transformer as shown below. Connect L1, L2, L3 leads to the 460 V terminals. Connect the ground lead to the forward ground stud. Ensure all connections are secure. Do not overtighten the strain relief.

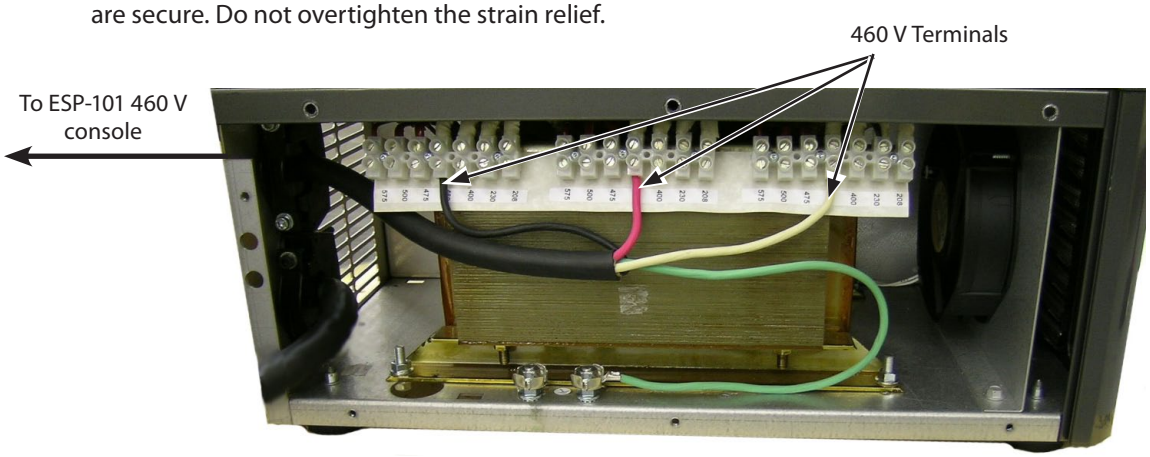


Figure 3-2c. Primary Power Cable from ESP-101 to TUA2 Auto-Transformer 460 V Terminals

CAUTION **Ensure three input power jumper cables are connected properly to the Auto-Transformer for your input power.**

The TUA2 Auto-Transformer is not equipped with an input power cable. A 4/c, type SO (90 °C) cable or equivalent is recommended. Ensure they are insulated copper conductors. You must have three (3 phase) power leads and one ground wire. Select an input power cable size corresponding to the input supply voltage listed in Table 3.1.

Primary Power Cable from Fused Line Disconnect Switch to TUA2 Auto-Transformer

Step 1: Begin by preparing the power cable, then positioning in the TUA2 as shown:

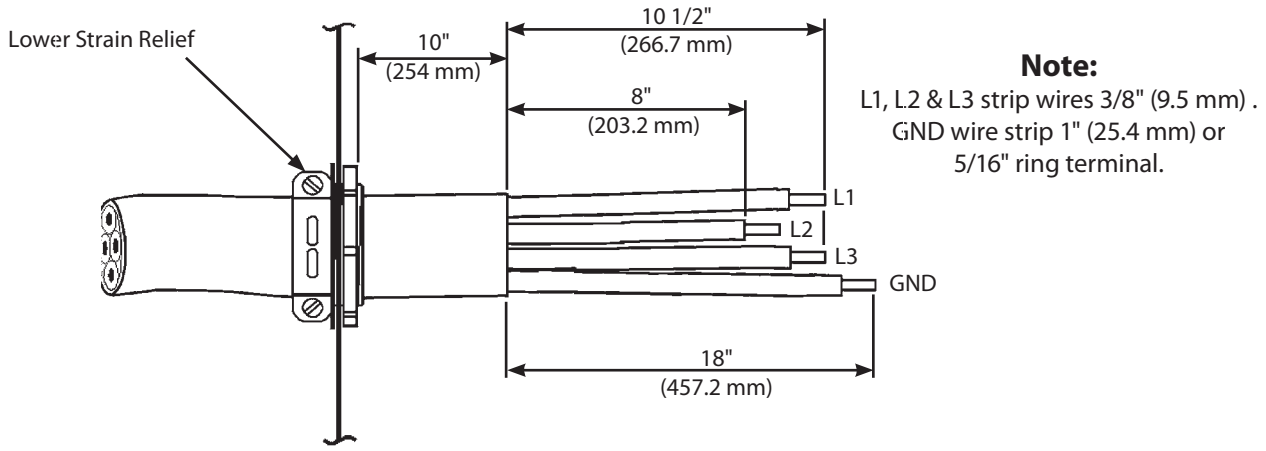


Figure 3-3a. Primary Power Cable from Fused Line Disconnect Switch to TUA2 Auto-Transformer

Step 2: Route the power cable through the lower strain relief of the TUA2 Auto-Transformer as shown below. Connect L1, L2, L3 leads to the voltage terminals that match your input power supply voltage. Connect the ground lead to the rear ground stud. Ensure all connections are secure. Do not overtighten the strain relief.

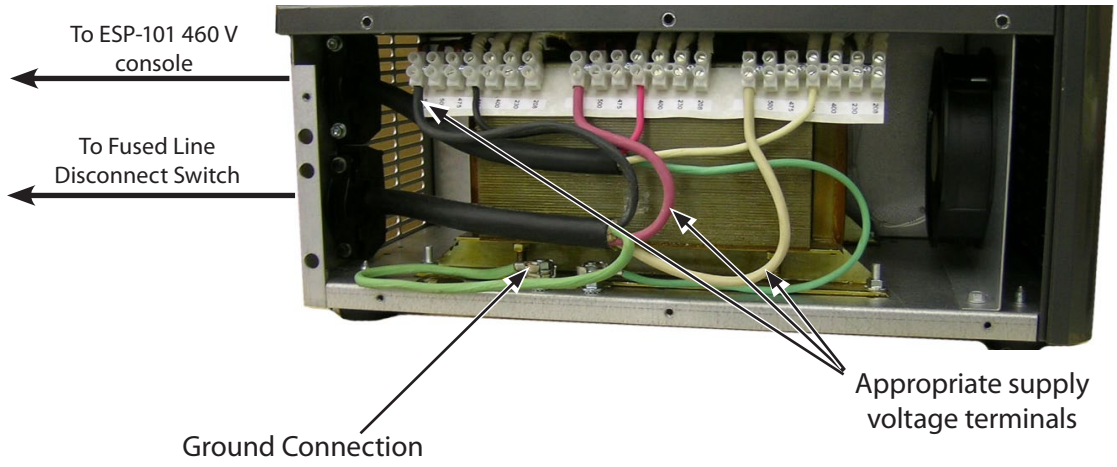


Figure 3-3b. Primary Power Cable from Fused Line Disconnect Switch to TUA2 Auto-Transformer appropriate supply voltage terminals (575 V pictured)

3.5.2 Input Air Connection

Connect your air supply to the inlet connection of the filter/regulator.

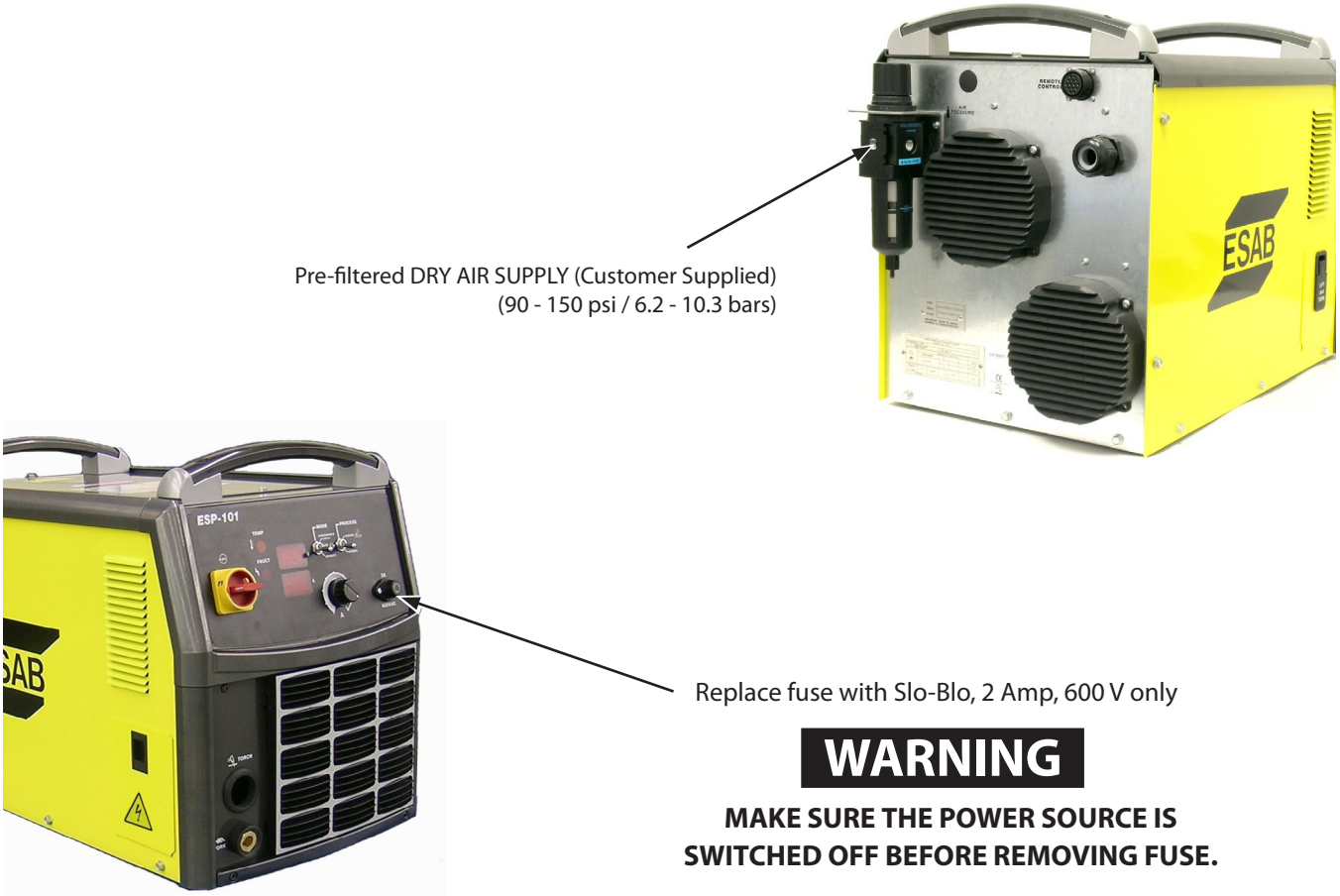
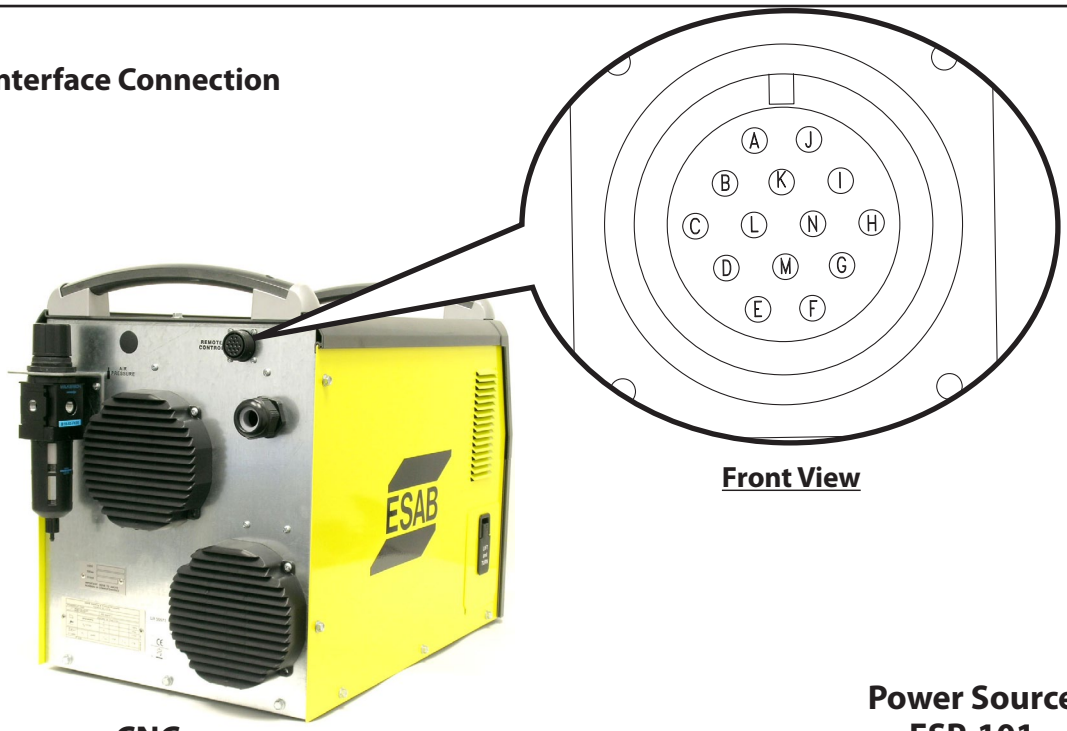

Pre-filtered DRY AIR SUPPLY (Customer Supplied)
(90 - 150 psi / 6.2 - 10.3 bars)
ESAB
ESP-101
Replace fuse with Slo-Blo, 2 Amp, 600 V only
WARNING
MAKE SURE THE POWER SOURCE IS
SWITCHED OFF BEFORE REMOVING FUSE.

Figure 3-4. Input Connections / Fuse Replacement

3.6 CNC Interface Connection



Note:

If replacing the ESP-100 with an ESP-101, reversing wires 1 and 2 on the CNC cable may be necessary for proper polarity.

Figure 3-5. Mechanical Cutting Interface Diagram CNC Interface Connection

3.6 CNC Interface Connection (continued)

Start signal (pin M)
Use a relay to connect this pin to "Common" (pin N) to start the cutting process.
If a transistor is used for this signal, then the positive potential must be connected to pin M and the common/negative to pin N. This would require a transistor capable of blocking 24 VDC and sinking more than 11 mA.

Corner / External Reference (pin E)
Use a relay to connect this pin to "Common" (pin N) to set the cut current reference signal to the external source- pins L and J.
If a transistor is used for this signal, then the positive potential must be connected to pin E and the common/negative to pin N.

Arc On (pins G and I)
These pins will be connected together, via normally open relay contacts that close when the plasma system has established work current. This signal is also referred to as "Motion Allow" or "Arc-Established".

Voltage Divider (VDR) for Automatic Height Control (pins C and H)
Pin C is the positive connection to the Voltage Divider Network. Pin H is the negative connection.
See section 3.7 for Voltage Divider default values and adjustment instructions.

Current Reference for Optional Remote Current Control (pins L and J)
This signal should be provided by an active driver that is referenced to ground. The signal is received (inside the power source) by a differential amplifier, insuring adequate input impedance for the driver. It is safe to connect output signal directly to pin L and the control common directly to pin J.
The reference signal will be scaled as follows:

- 0 V input, 20 Amps output
- 10 V input, 100 Amps output
- 20 Amps + 8 Amps per Volt input

Optional Input: Fault (pins A and B)
This is a power source fault signal that can be used to signal the external control that the plasma is in a fault condition. It is important to note that this is a transistorized and therefore polarized signal. A source voltage of at least 12 VDC, but no more than 30 VDC, should be applied to pin B. The fault signal will then come out on pin A.

WARNING **MAKE SURE POWER SWITCH ON CONSOLE IS IN OFF POSITION AND PRIMARY INPUT POWER IS DE-ENERGIZED.**

3.7 Voltage Divider Adjustment

It may be necessary to adjust the Voltage Divider or VDR to match the particular height control system. There are two default settings for the ESP-101 models as shipped from the factory:

- STANDARD UNITS (Non-CE): 750 ohms (21:1)
- CE UNITS (Europe): 789 ohms (20:1)

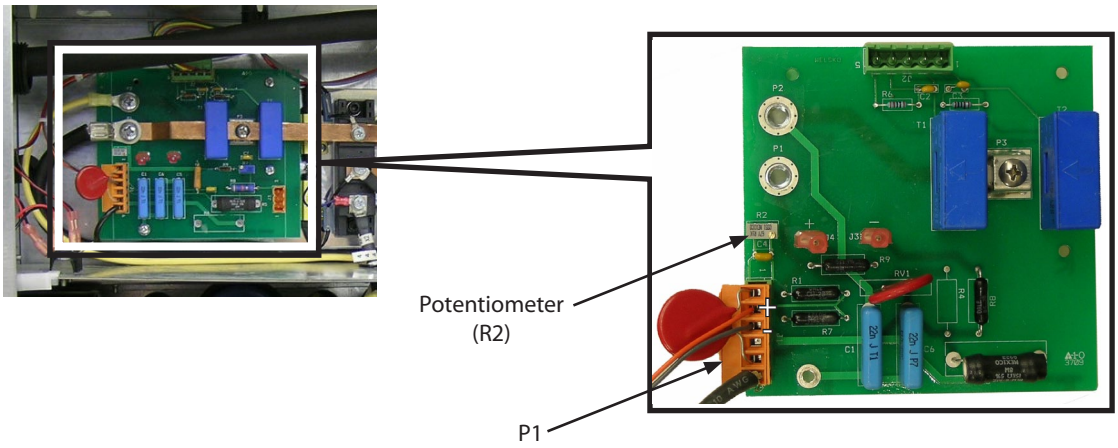
If the height control system does not match the factory default setting, matching can be accomplished by adjusting the VDR potentiometer on the Current Sensor PCB4 located behind the left side panel.

1. Place ohm meter leads between P1-2 (orn) & P1-3 (gry). Adjust R2 to achieve the desired divide ratio for the particular height control system used. For example:

   - 16:1 ratio 1000 ohms
   - 18:1 ratio 882 ohms
   - 21:1 ratio 750 ohms
   - 20:1 ratio 789 ohms

Note:
Ohm meter readings can also be taken at the CNC receptacle on the rear panel of the machine, between pins C and H.

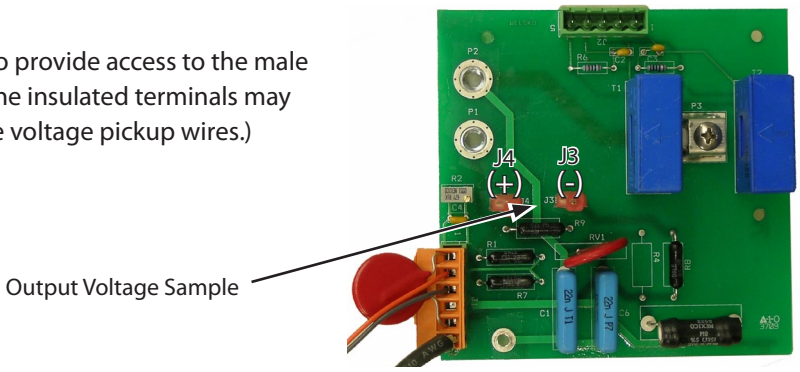
2. If desired, additional minor adjustments of the VDR potentiometer may be made. Any adjustments should be performed by a qualified technician.



3.7.1 Output Voltage Sample

Output Voltage Sample - Some Cutting Machines sample the full output voltage of the plasma system to control the torch height and to determine when to start moving. The full output voltage is available within the machine on a pair of male spade terminals (J3 and J4).

1. Remove insulated terminals to provide access to the male spade terminals. (If needed, the insulated terminals may then be used to terminate the voltage pickup wires.)



WARNING

CLAMP THE WORK CABLE TO THE WORK PIECE. BE SURE THE WORK PIECE IS CONNECTED TO AN APPROVED EARTH GROUND WITH A PROPERLY SIZED GROUND CABLE.

3.8 Secondary Output Connections for Mechanized Cutting

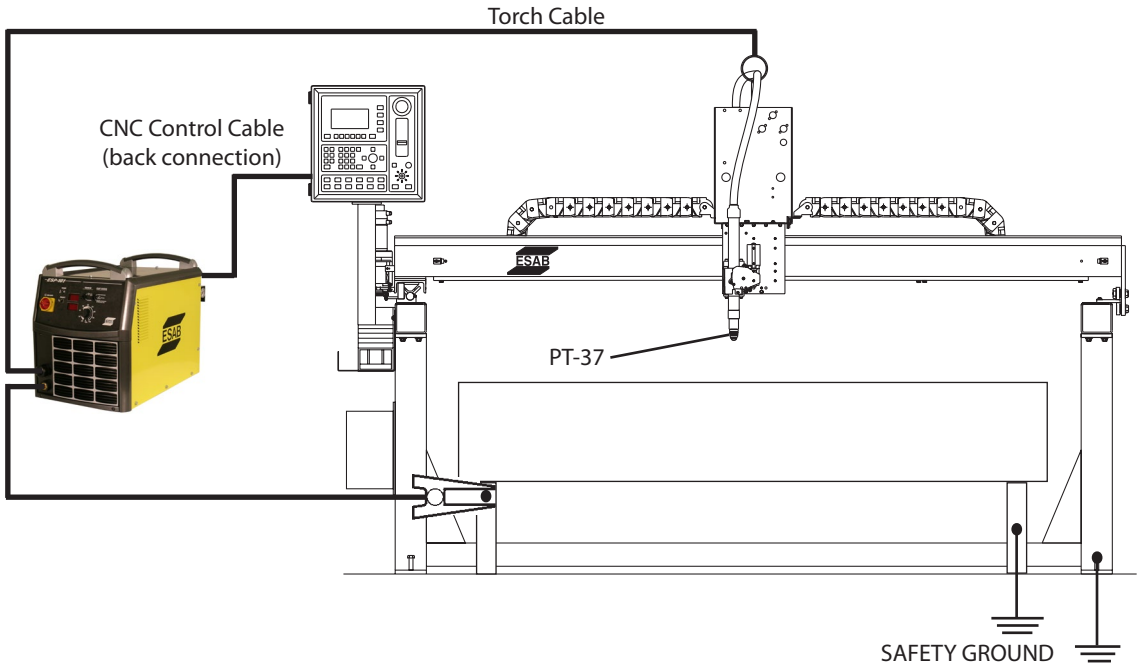


Figure 3-6. ESP-101 Interconnection Diagram

WARNING

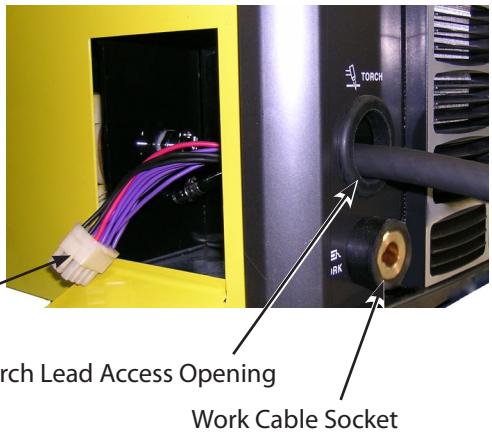
BEFORE MAKING ANY CONNECTIONS TO THE POWER SOURCE OUTPUT TERMINALS, MAKE SURE THAT ALL PRIMARY INPUT POWER TO THE POWER SOURCE IS DE ENERGIZED (OFF) AT THE MAIN DISCONNECT SWITCH.

3.9 PT-37 Torch Installation

1. Open lead access door on the left side of the ESP-101.

2. Route the torch cable through the access opening on the front of the console.

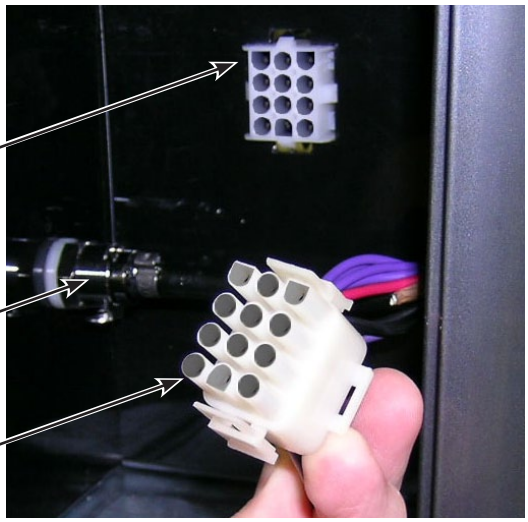
3. Connect the torch cable receptacle to the panel receptacle. Check orientation of the sockets to ensure a correct fit.



4. Connect the air hose to the quick-connect fitting.

5. Insert work cable plug into work cable socket on the front of the console and turn clockwise until secure.

6. Close the Torch Lead access door.



WARNING **MAKE SURE POWER SWITCH ON CONSOLE IS IN OFF POSITION AND PRIMARY INPUT POWER IS DE-ENERGIZED.**

3.10 Remote Junction Box Installation

The Remote Junction Box (RJB) provides a means to extend the total length of the PT-37 Torch. A Remote Junction Box is used in combination with 50', 75' or 100' extension cable and any standard length of PT-37 Plasma Torch from 4.5' to 50', to create a combined maximum torch length of 150 feet.

Installation of a Remote Junction Box requires minor modifications to the ESP-101 power supply, mounting of the box itself, and connection of the extension cable. Use the diagram and steps below for installation.

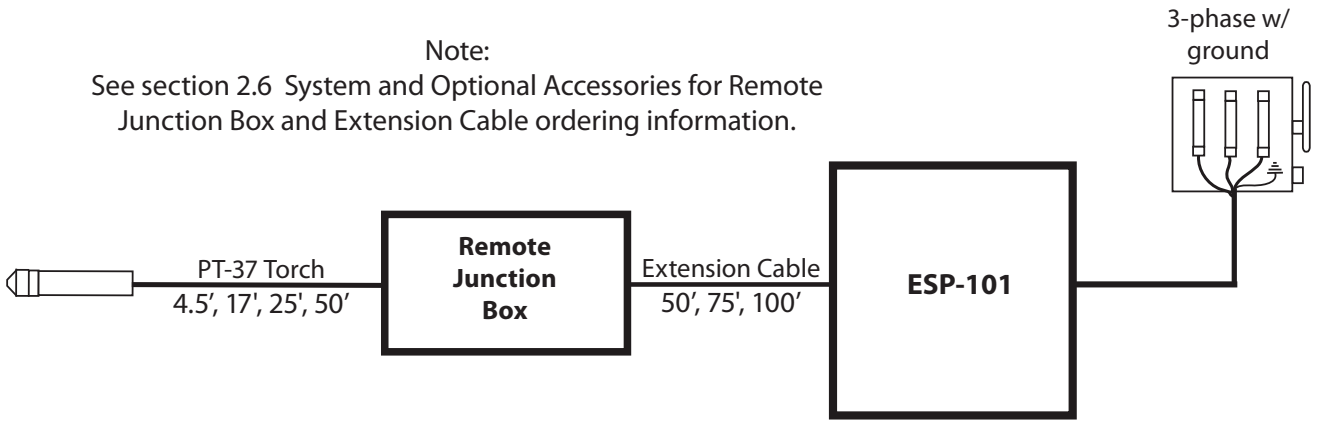
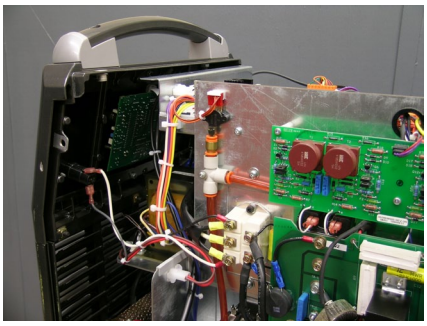


Figure 3-7. Connection Diagram for Remote Junction Box

DESCRIPTION of ESP-101 modification: The wiring modification (interconnect plug reversal) redirects the control signal from the ESP-101 internal solenoid, to the pins within the torch connection panel receptacle. The control signal is then diverted to the solenoid within the Remote Junction Box.

The hose modification (solenoid air bypass) directs the system air supply to the solenoid within the Remote Junction Box. This ensures air at a sufficient pressure is immediately available to the PT-37 torch.

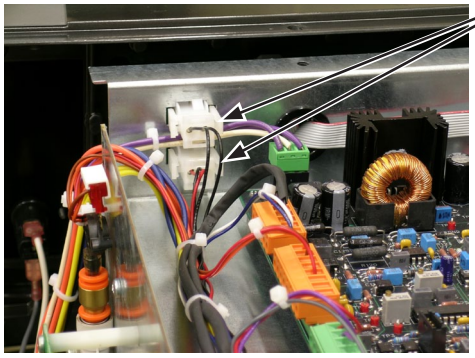
A. ESP-101 Modifications



Remove the top and right side panel of the power supply.

1. Redirection of solenoid control wiring:

   a. Locate, disconnect and reverse the trigger and solenoid interconnect plugs as shown.



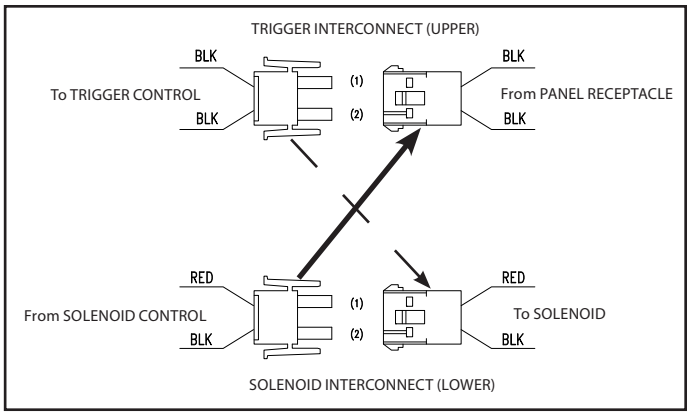
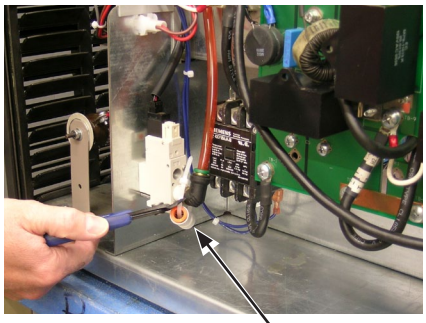
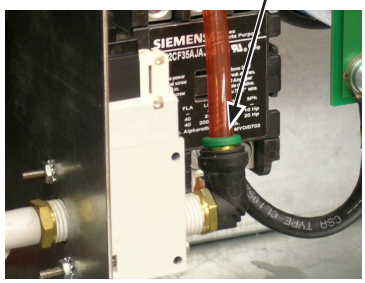


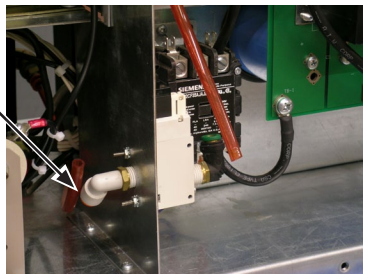
Figure 3-8. Interconnect Reversal

2. Air flow by-pass of internal solenoid:

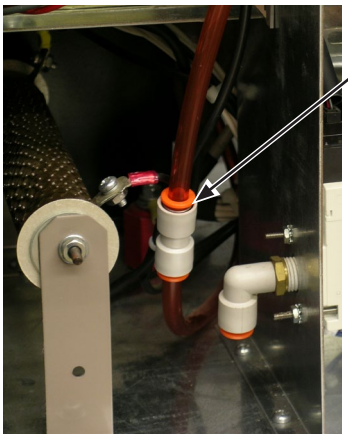
   a. Locate and remove the included supplied air coupling.
   b. Disconnect both air hoses from the input and output of the solenoid, by pushing ring inward and pulling hose.







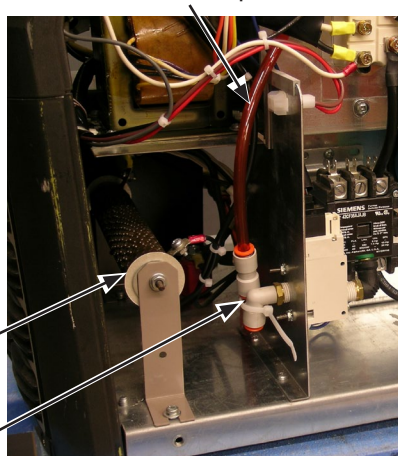
c. Re-route the Input Air Hose over to the output side.
d. Couple the free ends of the gas tubes together using the provided union.



(d) Couple the free ends of the gas tubes together

Important Note:
Ensure tubing is securely fastened at least 1 inch away from pilot arc resistor.

(c) Re-route Input Air Hose



Pilot Arc Resistor

(e) Secure the tubing

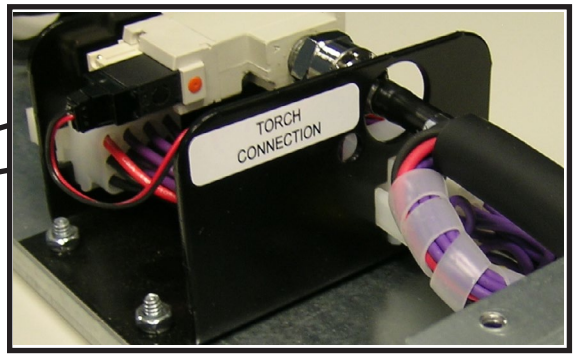
e. Secure the tubing to prevent contact with pilot arc resistor.
f. Replace the top and right side panel of the power supply.

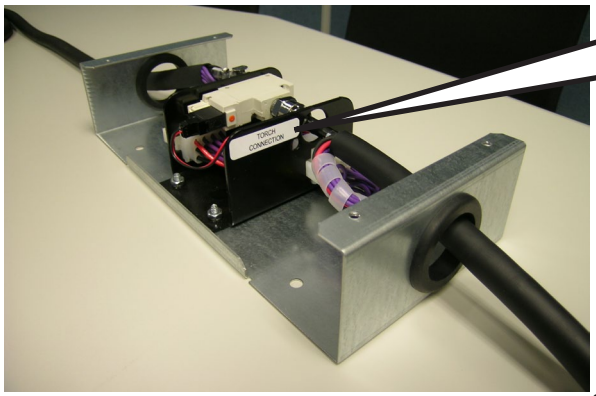
B. Mounting the Remote Junction Box (RJB)

1. With the cover removed from the Remote Junction Box, mount the base to a rigid location on the cutting machine, robot, or other suitable object, using at least 2 of the provided mounting holes. Orient the box such that the Extension Cable will enter the end of the RJB **not marked** for torch connection.

Remote Junction Box

Torch and Extension Cable Openings (typical at each end of Remote Junction Box)





2. Insert the free end of the Extension Cable through the grommet on the end of the RJB and make the power and gas connections as shown.
3. Insert the free end of the PT-37 Torch through the grommet on the other end of the RJB and make the power and gas connections as shown.

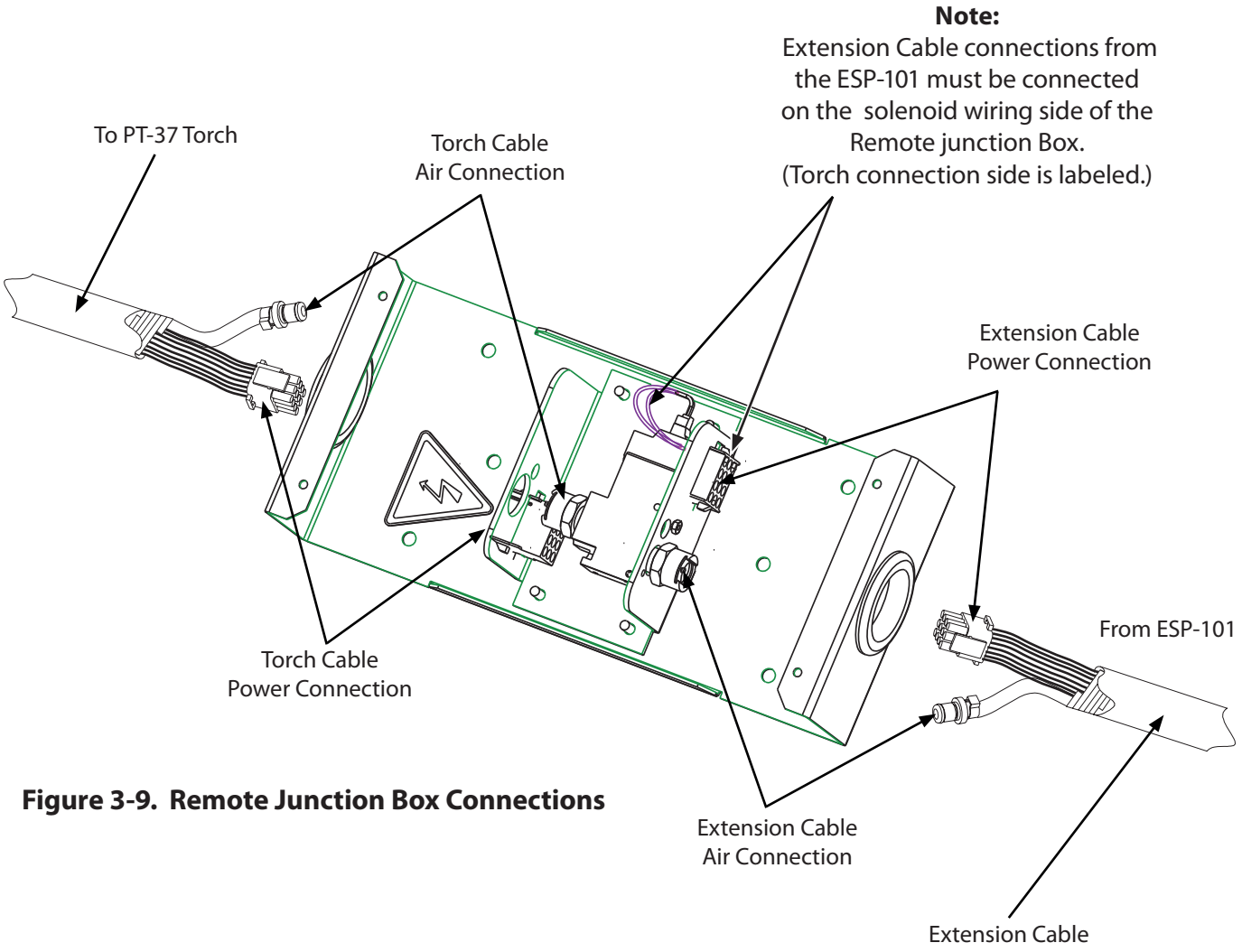

Note:
Extension Cable connections from the ESP-101 must be connected on the solenoid wiring side of the Remote junction Box.
(Torch connection side is labeled.)
To PT-37 Torch
Torch Cable Air Connection
Extension Cable Power Connection
From ESP-101
Torch Cable Power Connection
Extension Cable Air Connection
Extension Cable

Figure 3-9. Remote Junction Box Connections

4. Replace all covers and hardware.

C. Connecting to the ESP-101

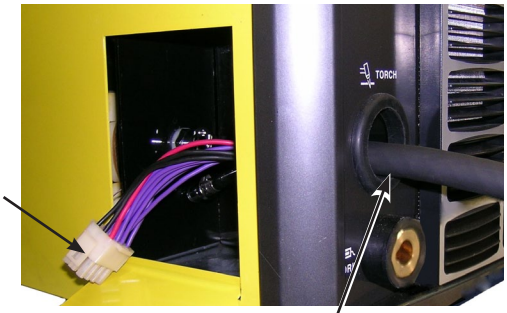
The Extension Cable is connected to the ESP-101 in the same manner as the PT-37 Torch.

1. Open extension cable lead access door on the left side of the ESP-101.

2. Insert the extension cable and air hose through the extension cable access opening on the front of the console.

Extension Cable Lead Access Door

Extension Cable and Air Hose

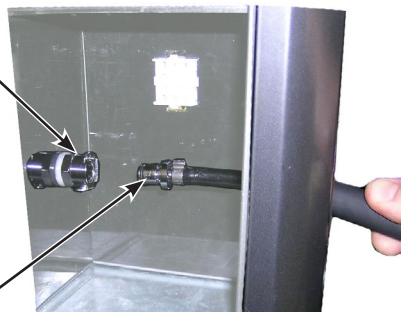


Extension Cable Access Opening

3. Connect the extension cable male receptacle (from Remote Junction Box) to the female receptacle. Check orientation of the sockets so as to ensure a correct fit.

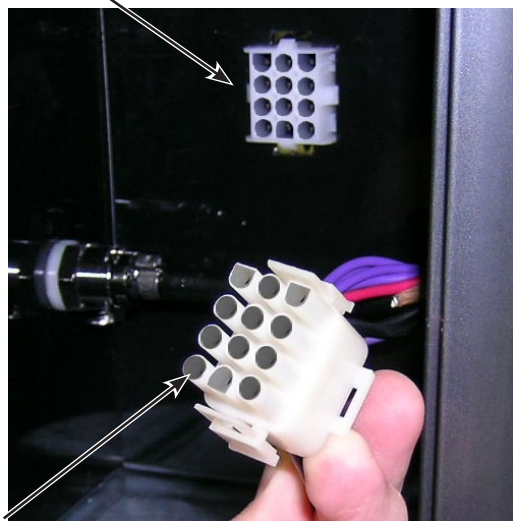
4. Connect the air hose (from Remote Junction Box) to the quick-connect fitting.

Quick-connect Fitting



Air Hose

Panel Receptacle



Extension Cable Male Receptacle

5. Close the Extension Cable Lead access door.

DANGER

ELECTRIC SHOCK CAN KILL.

- **Do NOT operate the unit with the cover removed.**
- **Do NOT apply power to the unit while holding or carrying the unit.**
- **Do NOT touch any torch parts forward of the torch handle (nozzle, heat shield, electrode, etc.) with power switch on.**

WARNING

ARC RAYS CAN BURN EYES AND SKIN; NOISE CAN DAMAGE HEARING.

- **Wear welding helmet with No. 6 or 7 lens shade.**
- **Wear eye, ear, and body protection.**

CAUTION

Position the ESP-101 at least 10 feet (3 meters) from the cutting area. Sparks and hot slag from the cutting operation can damage the unit.

4.1 ESP-101 Controls

A. Power Switch (ON-OFF)/(I-O). Turn knob clockwise to "ON" ("I") position for normal operation. Turn knob counterclockwise to switch "OFF" ("O").

Note that with the switch in the "ON" ("I") position, power is provided to the main transformer and the low voltage control circuitry. In the "OFF" ("O") position, the unit is shut down; however, power is still present in the unit. To remove power from the power source, power must be disconnected at the line disconnect switch or the fuse box.

B. Pressure Regulator. Regulates cut gas pressure. Rotate clockwise to increase and counterclockwise to decrease. Pressure reading is indicated on the lower display screen. Pressure unit of measure is indicated on the upper display screen.

Note:

With or without Junction Box installed: When using 4.5' (1.4 m) or 17' (5.2 m) torch assemblies, plasma gas settings should be reduced 5 - 10 psi (.35 - .69 bar) for optimum performance.

Note:

The unit is shipped from the factory with the regulator adjusted to deliver 80 psig (5.5 bar) to the torch from a 95 psig (6.5 bar) supply. If supply pressure to the machine is greater than 95 psig (6.5 bar) up to the maximum recommended 150 psig (10.3 bar), rotate pressure regulator knob counterclockwise to reduce the pressure delivered to the torch back to 80 psig (5.5 bar). Follow GAS TEST instructions, see D.2.

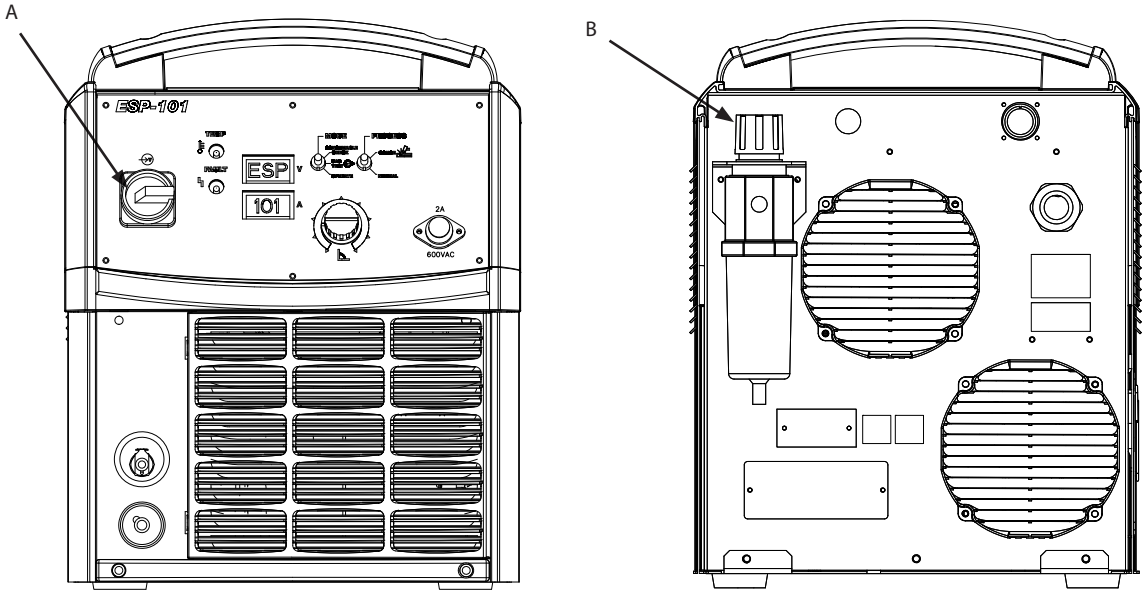


Figure 4-1. ESP-101 Controls

C. Output Current Control. Adjustable from 20 to 100 amperes. Calibration marks are to provide a guide in setting current. For settings refer to cut data charts in the torch manual.

D. MODE Selector Switch.

1. CONSUMABLE CHECK (UP position) - When placed in this position, the proper installation and operation of the consumables are verified by sending a series of gas pulses through the torch. PIP (Parts in Place) is indicated on the upper display screen.

An error message will be displayed if improper operation is detected. Err (Error) is indicated on the upper display screen. The Error code is indicated on the lower display screen. Refer to Section 6.2 List of Help Codes.

Be sure to place switch in OPERATE position before starting cutting operation.

2. GAS TEST (CENTER position) - The display screen will indicate flowing air pressure. Pressure reading is indicated on the lower display screen. Pressure unit of measure is indicated on the upper display screen (PSI or Bar). See section 7.4 for selecting air pressure units of measure.

The air regulator should be adjusted to recommended pressure before cutting operations. Allow air to flow for a few minutes. This should remove any condensation that may have accumulated during shutdown period.

Be sure to place switch in OPERATE position before starting cutting operation.

3. OPERATE (DOWN position) - Place switch in this position for cutting and gouging operations.

E. PROCESS Selector Switch. The process switch allows for selection of the output characteristics of the power source depending on the cutting process being used.

1. Normal. Setting for all standard plate cutting operations. (The pilot arc will not re-strike automatically. Requires a new start signal.)

2. Gouge. Optimizes power source for gouging operations. Gouging requires higher arc voltages. In this mode the power source allows higher operating arc voltage limiting the output current to 85 amps.

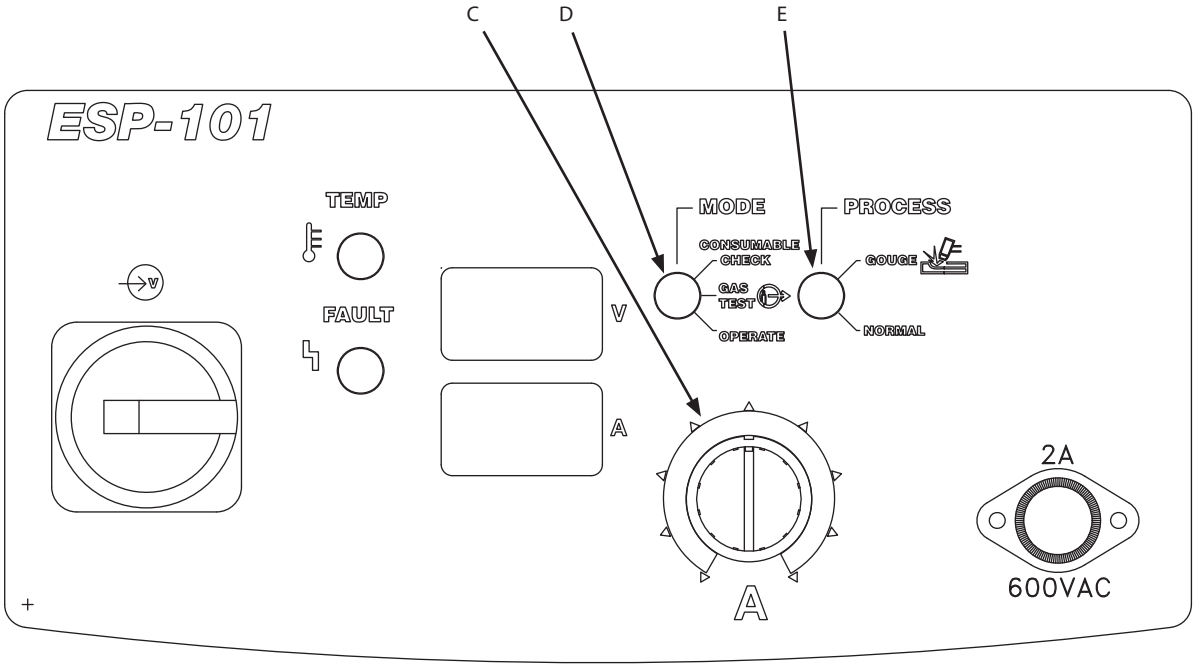


Figure 4-2a. ESP-101 Controls

F. Display Screens.

Voltmeter (UPPER) - Displays DC output voltage.
Ammeter (LOWER) - Displays output current setting.

The voltmeter and ammeter screens alternately display Model, Test and the Software version along with help code information (see Section 6.2 List of Help Codes).

When unit is initially switched on the Model, PIP (Parts in Place) and Software version will be briefly displayed. Lower display will then show Current Setting.

Important Note:
If after the initial sequence the display does not show the Current Setting but reverts back to displaying the model "ESP-101", the machine has detected a premature torch trigger condition. Disengage the torch trigger and restart the machine. (As a safety precaution, the ESP-101 will not power up with the torch trigger engaged.)

G. TEMP Indicator Lamp.

The amber lamp will illuminate to indicate an internal overheating condition has occurred, one of the thermal switches has opened. User control of the power source will be interrupted and the unit will shut down to protect critical components. Leave the power on to allow the fan time to cool off the unit. Once cooled to a safe temperature, the thermal switch will automatically reset and output control will be restored.

H. FAULT Indicator Lamp.

The red lamp will illuminate to indicate an error has occurred, operator attention is required. See item F. Display Screens and refer to Section 6.2 List of Help Codes.

Note:

Most fault signals will remain on for a minimum of 10 seconds.
Unit will reset automatically after faults are cleared except for over-current protection.

Error Indication:

An error message will be displayed if improper operation is detected. Err (Error) is indicated on the upper display screen. The Error code is indicated on the lower display screen. Refer to Section 6.2 List of Help Codes.

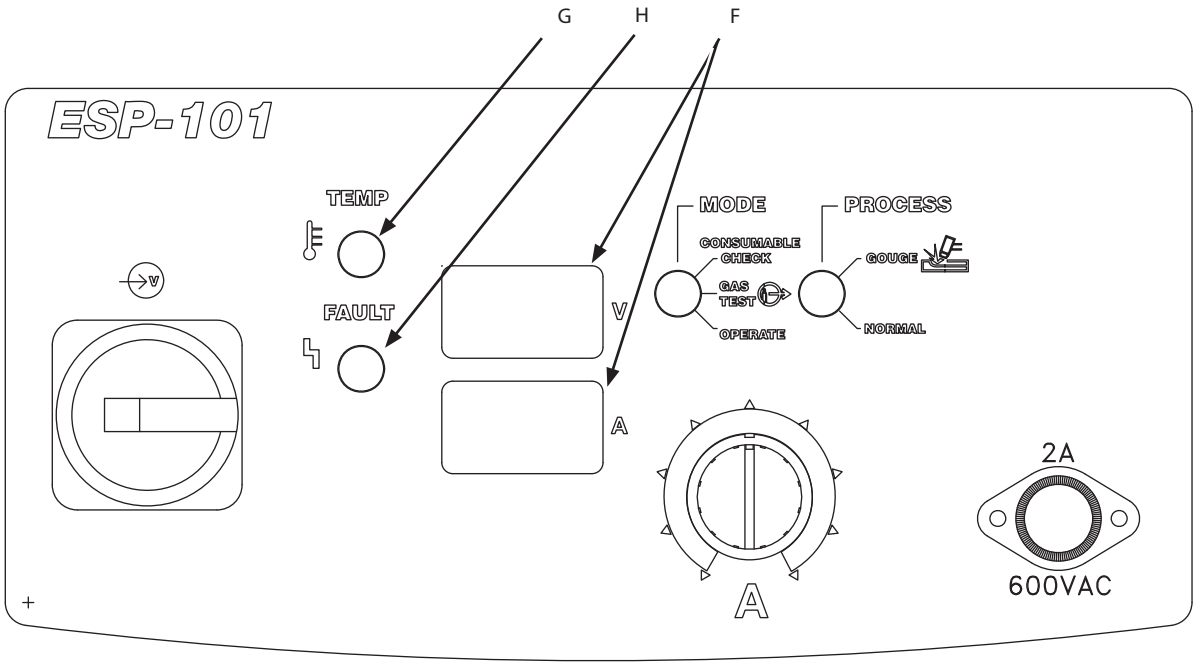


Figure 4-2b. ESP-101 Controls

WARNING **MAKE SURE POWER SWITCH ON UNIT IS IN OFF POSITION BEFORE WORKING ON THE TORCH.**

WARNING **THE PT-37 TORCH HEAD ACTS IN CONJUNCTION WITH THE CIRCUITRY WITHIN THE POWER SOURCE TO PREVENT THE TORCH FROM BEING ENERGIZED WITH HIGH VOLTAGE IF THE TORCH SWITCH IS ACCIDENTALLY CLOSED WHEN THE SHIELD IS REMOVED. ALWAYS REPLACE TORCH WITH THE PROPER TORCH MANUFACTURED BY ESAB SINCE IT ALONE CONTAINS ESAB'S SAFETY INTERLOCK.**

4.2 Cutting with the ESP-101

A. Make sure that the wall disconnect switch is on and air is supplied to machine.

B. Turn on the front panel power switch.

C. Place MODE selector switch to "GAS TEST". Set Pressure Regulator to 80 psig (5.5 bar).

D. Place MODE selector switch to "OPERATE".

E. Place PROCESS selector switch to either "NORMAL" or "GOUGING".

F. For in depth instructions refer to torch manual for complete operation and maintenance.

G. Periodically check torch head assembly. Replace if worn or damaged.

H. Torch cable should be inspected periodically. If there are any cuts through the protective sheath or wire insulation, replace the cable.

CAUTION **REPLACE ELECTRODE BEFORE WEAR BECOMES DEEPER THAN .060" INCH (1.5 MM)**

4.3 Electrode Wear

If the electrode has a pit which is more than .06" (1.5mm) deep at its center, it must be replaced. This is done by unscrewing the electrode in a counter-clockwise direction from the piston. If the electrode is used beyond this recommended wear limit, damage to the torch and power source may occur. Nozzle life is also greatly reduced when using the electrode below the recommended limit.

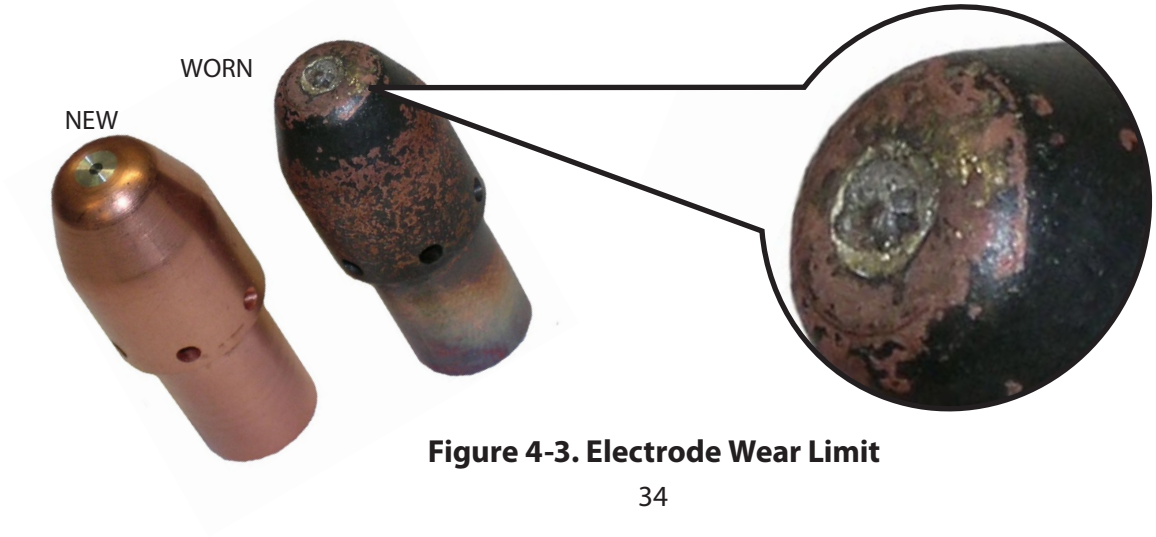


Figure 4-3. Electrode Wear Limit

4.4 Standoff and Cut Quality

Standoff (Arc Voltage) has a direct influence on cut quality and squareness. It is recommended that prior to cutting, that all cutting parameters are set to the manufacturer's suggested conditions. Refer to the Operation section Process Data in the torch manual for recommendations. A sample cut should be made using actual part material followed by close examination of the part.

If the cut face of the part has excessive bevel or rounded top edge, it may be that the standoff is set too high. When standoff is controlled by an arc voltage height control, reducing the arc voltage setting will reduce the standoff.

Lower the standoff until the excessive bevel or rounded top edge disappears. Note that on material thicknesses of 1/4" (6.4 mm) or greater, a standoff too close may result in a negative cut angle.

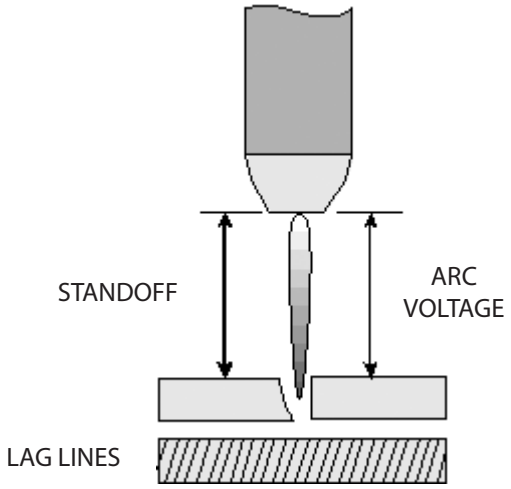
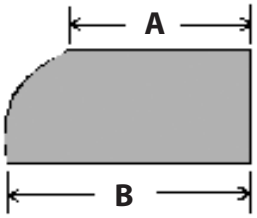


Figure 4-4. Cut Quality

POSITIVE (+) CUT ANGLE

Bottom dimension "B" is greater than dimension "A"



NEGATIVE (-) CUT ANGLE

Bottom dimension "B" is less than dimension "A"

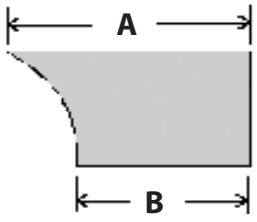


Figure 4-5. Cut Angle

4.5 Dross Formation

Cutting speed, gas selection and variations in metal composition contribute to dross formation. The correct cutting standoff also has an influence on dross formation. If the arc voltage is set too high, the cut angle becomes positive. In addition, dross forms on the bottom edge of the part. This dross can be tenacious and require chipping and grinding for removal. Setting the cutting voltage too low results in undercutting the parts or negative cut angle. Dross formation occurs but in most cases it is easily removed.

Top Dross

Top dross usually appears as splatter near the top edge of the kerf. This is a result of torch standoff (arc voltage) set too high or cutting speed set too fast. Most operators use the parameter charts for recommended speed. The most common problem is torch standoff or arc voltage control. Simply lower the voltage settings in increments of 5 volts until the top dross disappears. If an arc voltage control is not used, the torch can be lowered manually until the dross disappears.

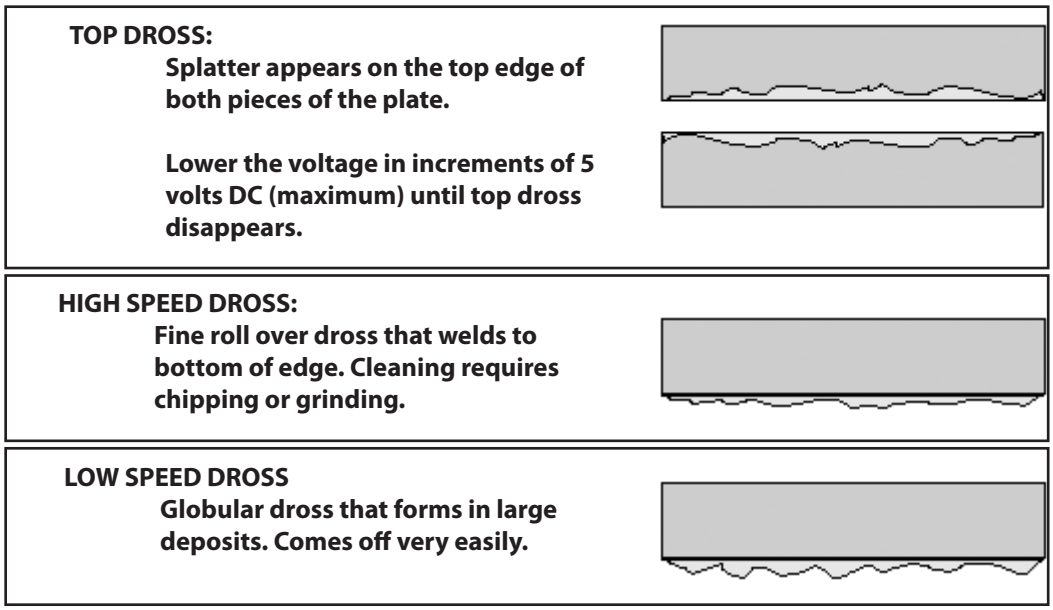

TOP DROSS:
Splatter appears on the top edge of both pieces of the plate.
Lower the voltage in increments of 5 volts DC (maximum) until top dross disappears.
HIGH SPEED DROSS:
Fine roll over dross that welds to bottom of edge. Cleaning requires chipping or grinding.
LOW SPEED DROSS
Globular dross that forms in large deposits. Comes off very easily.

Figure 4-6. Dross Formation

SUMMARY

Arc voltage is a dependent variable. It is dependent upon cutting amperage, nozzle size, torch standoff, cut gas flow rate and cutting speed. An increase in arc voltage can result from a decrease in cutting speed, an increase in cutting amperage, a decrease in nozzle size, an increase in gas flow and an increase in torch standoff. Assuming that all of the variables are set as recommended, torch standoff becomes the most influential variable to the process. Good and accurate height control is a necessity in producing excellent cut quality.

4.6 Common Cutting Issues

Listed below are common cutting problems followed by the probable cause of each. If problems are determined to be caused by the ESP-101, refer to the maintenance and troubleshooting sections of this manual. If the problem is not corrected after referring to the maintenance and troubleshooting sections, contact your ESAB distributor.

A. Insufficient Penetration.

1. Current too low.
2. Cutting speed too fast.
3. Damaged cutting nozzle.
4. Improper air pressure.
5. Low air flow rate.
6. Standoff too high - Nozzle to plate distance.

B. Main Arc Extinguishes.

1. Cutting speed too slow.
2. Worn electrode.
3. Standoff too high - Nozzle to plate distance.

C. Dross Formation. (In some materials and thicknesses, it may be impossible to get dross-free cuts.)

1. Current too low.
2. Cutting speed too fast or too slow.
3. Improper air pressure.
4. Faulty nozzle or electrode.
5. Low air flow rate.

D. Double Arcing. (Damaged Nozzle Orifice.)

1. Low air pressure.
2. Damaged cutting nozzle.
3. Loose cutting nozzle.
4. Heavy spatter accumulation on nozzle.
5. Nozzle contact with workpiece during starting or cutting operation.

E. Uneven Arc.

1. Damaged cutting nozzle or worn electrode.
2. Heavy spatter accumalation on nozzle or torch heat shield.

F. Unstable Cutting Conditions.

1. Incorrect cutting speed.
2. Loose cable or hose connections.
3. Electrode and/or cutting nozzle in poor condition.

G. Main Arc Does Not Strike.

1. Worn electrode.
2. Loose connections.
3. Work cable not attached.

H. Poor Consumable Life.

1. Improper air pressure.
2. Contaminated air supply.
3. Low air flow rate.
4. Incorrect current setting for consumable set installed in torch.